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WHAT IS CLAIMED IS:

1. A method of decoding a multidimensional symbol, the method comprising the steps of:

receiving a signal vectors $\mathbf{y}_{1...}\mathbf{y}_{k}$ into a sub-optimal decoder and generating an estimated transmitted multidimensional symbol $\tilde{\mathbf{S}}$ therefrom;

decoding the estimated transmitted symbol vector S via hierarchical subset decoding and determining a subset therefrom;

generating a reduced search space V associated with the subset; and decoding $\mathbf{y}_{1...}\mathbf{y}_{k}$ via minimum distance decoding in order to obtain one of the following: the estimated transmitted multidimensional symbol $\hat{\mathbf{S}}$, soft bit information, hard bit information.

- 2. The method according to claim 1 wherein the step of generating a reduced search space V via the minimization of some metric d.
- 3. The method according to claim 1 wherein the step of generating a reduced search space V associated with the subset comprises generating a reduced search space by minimizing a metric d corresponding to the subset prior to generation of the subset.
- 4. The method according to claim 1 wherein the step of receiving signal vectors $\mathbf{y}_{1...}\mathbf{y}_{k}$ into a sub-optimal decoder and generating an estimated transmitted multidimensional symbol $\tilde{\mathbf{S}}$ therefrom comprises receiving a signal vector $\mathbf{y}_{1...}\mathbf{y}_{k}$ into a sub-optimal decoder and generating soft bit information therefrom.

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5. The method according to claim 1 wherein the step of decoding the received signal

vectors $y_{1...}y_k$ via minimum distance decoding using the reduced search space V and

generating a multidimensional symbol S therefrom comprises decoding the received

symbol vectors $\mathbf{y}_1...\mathbf{y}_k$ via minimum distance decoding using the reduced search space V

and generating a multidimensional symbol Stherefrom.

6. The method according to claim 1 wherein the step of receiving signal vectors

 $y_1...y_k$ into a sub-optimal decoder and generating an estimated transmitted

multidimensional symbol vector S therefrom comprises receiving signal vectors $y_1...y_k$

into an interference cancellation decoder and generating an estimated transmitted symbol

vector S therefrom.

7. The method according to claim 6, wherein the interference cancellation decoder is

selected from the group consisting of a successive interference cancellation decoder, and

a parallel interference cancellation decoder.

8. The method according to claim 1 wherein the step of receiving signal vectors

 $y_{1...}y_{k}$ into an unordered linear decoder and generating an estimated transmitted

multidimensional symbol vector S therefrom comprises receiving signal vectors y_{1...}y_k

into a suboptimal decoder and generating an estimated transmitted symbol vector

S therefrom.

9. The method according to claim 8, wherein the unordered linear decoder consists

of a decoder selected from the group consisting of a zero forcing decoder, a MMSE

decoder, and a matched filter receiver.

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10. The method according to claim 1, wherein the multidimensional transmitted symbol $\hat{\mathbf{S}}$ is represented by the relationship $\hat{\mathbf{S}} = \arg\min_{\mathbf{v} \in \mathcal{V}} m(\mathbf{y}_1, ..., \mathbf{y}_k, \mathbf{v})$, and wherein m is any metric.

11. The method according to claim 1, wherein the step of decoding the estimated transmitted symbol vector $\tilde{\mathbf{S}}$ via hierarchical subset decoding and determining a subset therefrom comprises the steps of:

defining a hierarchical subset as an ordered set of subsets that cover a multidimensional constellation, wherein the hierarchical subsets are ordered such that if Hk and Hn are coverings of the constellation, and k<n, then union (Hk, Hn)=Hk; and decoding the received symbol over the covering Hk using a desired distance.

- 12. The method according to claim 11, wherein the desired distance comprises the Euclidean distance of the received vector from the center of each of the sets within Hk.
- 13. The method according to claim 11, wherein the step of decoding the received symbol over the covering Hk using a desired distance comprises the steps of: returning a set Vk in Hk;

decoding to a subset V(j+1) in intersection (H(j+1), Vj) at the (j+1) stage of decoding;

terminating the hierarchical decoding when j is equal to a desired integer L; and implementing ML decoding using VL as a reduced search space.